When lightning strikes twice

Risk Commentary

Pension funds face a difficult challenge in coping with market volatility and modelling risk. Lisa Goldberg describes some of the available options in statistical analysis

"Unless drastic measures are taken to save it, the capitalist system throughout the civilised world will be wrecked within a year." It was only a year ago that the prospect of economic apocalypse dominated the media. Global markets appear tamer now, as volatility has dropped back to pre-crisis levels – but the sense of well-being associated with the recovery is undermined, to some extent, by the disturbing possibility that more turbulence may lie ahead. Drastic measures have been taken to restore a modicum of stability to global markets. Their sustenance and growth requires that institutional investors incorporate broad, dynamic, transparent, empirically sound quantitative risk models and stress tests in their investment and risk management processes.

Future market disruption is inevitable, as is underscored by the 29-year time series of daily returns to the MSCI UK Index (figure 1). This market history spanning several decades reveals calm periods of variable length punctuated by turbulent eruptions, which vary in duration, intensity and other characteristics: extreme risk has been endemic to financial markets, even if it was not always in evidence. For example, the low-volatility four-year period between the collapse of the internet sector and the recent financial crisis missed important aspects of risk, including clusters of extreme events and turbulence.

Pension funds worldwide are searching for ways to meaningfully account for extreme risk in their investment processes. The static statistical analysis underlying many financial models and investment guidelines does not explain the relatively frequent recurrence of market disruptions or the cluster risk that comes from the accompanying alignment of assets and sectors that are normally uncorrelated. True diversification comes from an understanding of market fundamentals, such as the risk factors that are common to asset classes that have traditionally been viewed as distinct. It also relies on empirically-grounded quantitative methods that account for the emergence, evolution and interaction of these risk factors under different conditions and through time. Calibrated to a long data history, a new generation of dynamic, empirically-motivated, factor-based investment tools can generate risk forecasts that take account of financial turbulence without over-forecasting volatility in calm regimes.

The most basic extreme risk measure is shortfall (also known as expected shortfall, conditional value at risk, and expected tail loss): the expected loss, given that a specified (value-at-risk) threshold is breached. Figure 2 illustrates an effective shortfall-forecasting strategy: 29 years of daily returns to MSCI UK are scaled to the current level of volatility, and the most severe scaled losses – extreme events relative to their volatility regimes – are averaged. The

### 1: Daily returns to the MSCI UK index from January 1980 - November 2009
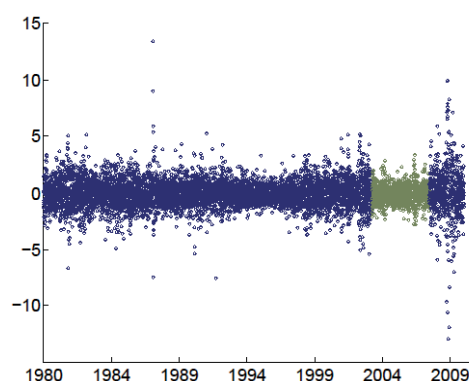
Losses are positive and gains are negative. The highlighted time period, January 2003 - July 2007, is the low volatility regime between the internet bubble and the sub-prime mortgage crisis.
Source: MSCI Barra

2: Daily returns to the MSCI UK index scaled to the current volatility regime
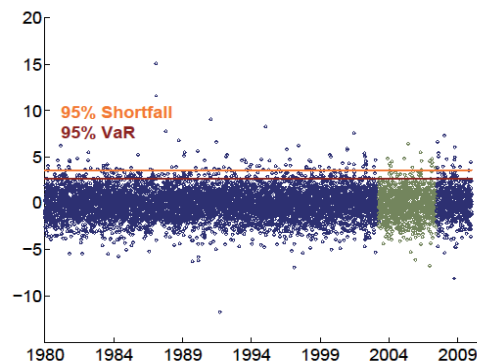
An accurate estimate of 95% shortfall is the average over the most severe 5% of rescaled returns. The rescaling process equalises returns across volatility regimes.
Source: MSCI Barra

3: Time evolution of contagion and standard correlations between MSCI UK and the Barra Europe Equity Model growth factor
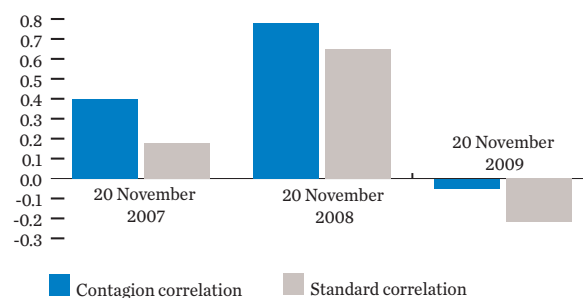
Source: MSCI Barra

importance of volatility scaling is made plain by the observation that a 5% one-day loss to the MSCI UK was not so unusual in the fall of 2009, although it would have been extraordinary in 2006.

A novel perspective on financial diversification can be obtained from contagion correlation, which measures the risk of extreme events clustering. Like standard correlation, contagion correlation is sensitive to co-movements of securities, asset classes, sectors and risk factors, but it is expressed in terms of shortfall instead of volatility, it distinguishes gains from losses, and it is concentrated on highly improbable events. The term reflects the idea that the coincidence of extreme events may be rooted in counterparty relationships, low liquidity, or a trough in the business cycle.

We illustrate these two types of correlations in figure 3, which shows the time evolution of contagion and standard correlations between the MSCI UK and the Barra Europe Equity Model (EUE3) growth factor. The return to the growth factor is an average of returns to UK firms whose assets or earnings have recently increased, or are forecast to increase in the near term. The first date we consider is 20 November 2007 – after the initial sub-prime mortgage crisis in August 2007 and before the major turbulence of 2008. We see a modest positive correlation between the growth factor and the index, although the contagion correlation exceeds the standard correlation. A year later, both coefficients have increased and the discrepancy between them has decreased. This can be explained by the nature of the crisis, which exhibited extreme volatility (as opposed to extreme events) and blurred the distinctions among risk measures. A fund manager could have heeded the relatively high forecast of contagion correlation between growth and the index late in 2007 and hedged exposure to that factor: growth stocks did not perform well in November 2008 as indicated by their high correlations with the index.

On its own, a static statistical analysis based on market volatility cannot account for two enormous economic disasters within a single century. Nevertheless, the Great Depression of the 1930s and our current situation are separated by only eighty years. Both followed regimes of easy credit and a dismissive attitude to financial risk and were characterised by enormous destruction of wealth, rampant foreclosures and unemployment, frozen credit, widespread concern about the viability of banks, and a fear that capitalism had failed. The opening words of this article were spoken in 1931 by Montagu Collet Norman, Governor of the Bank of England. They could just as easily have been a headline early in 2009.

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